SRC India Research Program: Research Needs
April 4, 2022

The Semiconductor Research Corporation (SRC) India Research Program (IRP) member companies are pleased to release this document that describes the 2021 research needs.

The India Research Program research needs of the members are described in two major categories:

- Tools, Flows, and Methods
- Architectures and Circuits

Each of these major categories are broken down into several sub-categories which describe the need in more detail. Even so, these are written to be broad in nature to not restrict the investigator's approach. There is no priority assigned to the order of either the major categories or the sub-categories.

SRC has also released a document called the Decadal Plan for Semiconductors (www.src.org/about/decadal-plan/) which describes five "Seismic Shifts" facing the electronics industry in the coming decade. Research should address issues arising from one of them:

- Smart Sensing – The Analog Data Deluge
- Memory & Storage – The Growth of Memory and Storage Demands
- Communication – Communication Capacity vs. Data Generation
- Security – ICT Security Challenges
- Energy Efficient – Compute Energy vs. Global Energy Production

While a particular research submission might address the challenges of multiple shifts, each investigator should choose one which best aligns to their effort, perhaps at the end application level.

Moving forward, the SRC is also embarking on an effort to broaden participation in its funded research programs. This aggressive agenda will help us drive meaningful change in advanced information and communication technologies that seem impossible today. In the programs we lead, we must increase the participation of women and under-represented minorities as well as strike a balance between U.S. citizens and those from other nations, creating an inclusive atmosphere that unlocks the talents inherent in all of us. Please visit, https://www.src.org/about/broadening-participation/, for more information about the 2030 Broadening Pledge.

This needs document is driving the India Research Program solicitation. It is issued to universities throughout India, may be addressed by an individual investigator or a research team. Our selection process is divided into two stages. The interested party is requested to submit a brief 1-page white paper. The white paper should clearly identify what can be done in three years. A successfully selected white paper will result in an invitation to submit a full proposal. These proposals will be further down selected for SRC research contracts.

Investigators who are funded will be expected to publish at top-tier conferences, including but not limited to ISSCC, VLSI, HPC, ISCA (part of Federated Computing Research Conference), and ESWEEK (CASES, CODESISSS, & EMSOFT). Also, if open-source software is to be developed, SRC encourages the use of MIT licensing terms when made available https://opensource.org/licenses/MIT.

White Papers for all the categories below will be considered for funding. Investigators are limited to participation in two white papers in this IRP solicitation. Submissions should highlight major category needs are addressed, such as "I1" as well as which seismic shift the research would impact.

CONTRIBUTORS

Analog Devices	Sri Ranganayakulu, Aravind Navada, Krishna Vishnubhatla
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2022 India Research Program Needs Categories	
I1	**Tools, Flows, and Methods**
I1.1	Design for robustness: tools, techniques, architectures, and systems
I1.2	Test techniques: yield learning, RF, mm-wave, high-speed, high-level, diagnosis, and repair, approximate test, big data analysis, analog BIST, defect coverage driven alternate / structural tests, and fast methods for analog fault simulation
I1.3	Design verification and validation techniques: core algorithms, formal approaches, model generation, analog/mixed-signal, mm-wave, post-silicon, system-level, and security
I1.4	Design for safety and safety mechanisms, and safety analysis techniques
I1.5	Design optimization for functions including power management, energy harvesting, clocking, and RF baseband
I1.6	Compact circuit simulation models for analog/mixed-signal devices
I1.7	System level design optimization, including early exploration with SW/HW co-development for multi-core SoC designs, and energy efficiency
I1.8	Design for security of information systems, embedded systems, and automotive systems, including accelerators and HW/SW co-design
I1.9	Sensor design, calibration, and test including application interfaces and protocols
I1.10	Techniques to accelerate ecosystem development of semiconductor manufacturing
I1.11	Design automation of neuromorphic and in-memory circuits
I1.12	Technology CAD for nano-scale devices
I1.13	Security in cloud computing for EDA and other applications
I1.14	Machine Learning (ML) approaches to address above needs
I2	**Architectures and Circuits**
I2.1	AI, cognitive, machine learning, and deep learning: architectures, techniques, and applications for IoT edge devices to the cloud
I2.2	Cloud computing, analytics: enabling architectures, techniques, and applications
I2.3	Edge computing including inference adaptability and online learning
I2.4	Architectures, accelerators, reconfigurable computing, hardware-software co-optimizations for cognitive computing, machine/deep learning, computer vision, depth perception, and audio
I2.5	Next generation radar, mmWave (sensing and classification), and LIDAR (modulation schemes and interference mitigation)
I2.6	Architectures for near-memory and in-memory computing using both traditional memories and emerging non-volatile memories
I2.7	Cache and memory hierarchies for general-purpose and domain-specific systems
I2.8	Security and safety of analog signal chains
I2.9	Architectures for approximate computing, approximate test, and approximate security
I2.10	Architectures and circuits to enable application driven energy management